The Emery mine pumps approximately 149~~37~~,000,000 gallons of water per year from the mine. The water that is used for dust suppression is accounted for in the ventilation calculation and the coal moisture consumption calculation. Portions of the water sprayed on the coal are either evaporated by the ventilation process, drain back into the mine drainage system, or is carried out in the product. The consumed volume is accounted for in the ventilation evaporation calculation and the coal moisture consumption calculation.

Mining consumption: See above explanation, and coal moisture consumption calculation

Ventilation consumption: See Ventilation evaporation calculation

Coal producing consumption: See coal moisture calculation

Ventilation evaporation: There is no data currently available to calculate the loss due to ventilation. With the fan returning approximately 218,000 CFM, this could evaporate approximately 25 ac-ft per year. This amount will vary based on the volume of air returned from the mine, the barometric conditions of the mine air and the barometric conditions of the outside air, as well as temperature of both.

Sediment pond evaporation: Water entering the sediment ponds is stored long enough to allow the accumulated sediment to drop out. The water is allowed to discharge into the receiving stream. This would not be considered a consumptive mechanism.

Springs and seep effects from subsidence: There have been no reports of seeps from subsidence.

Alluvial aquifer abstractions into mines: There are no water infiltrations from alluvial systems into the mine.

Alluvial well pumpage: There is zero pumpage from alluvial wells.

Deep aquifer pumpage: There is zero pumpage from deep aquifer wells.

Post mining inflow to old workings: There is zero post mining inflow to the old workings

Coal moisture consumption: The inherent moisture in the Emery coal is approximately 4 %. The as received moisture of the coal is approximately 6 %. The maximum Emery Mine production~~ed~~ could be 1,300,000~~243,153~~ tons of coal. ~~in 2003.~~ Using these values, the consumption was approximately 19.2~~3.6~~ ac-ft. ~~in 2002.~~

Direct diversion: There are no direct diversions at the Emery mine therefore zero consumption.

Adding the two approximate losses together equals 44.2~~26.6~~ ac-ft. Historically (2002 thru 2005) ~~T~~the mine pumped~~s~~ and discharged~~s~~ approximately 149~~37~~,000,000 gallons (456~~20~~ ac-ft) of water per year. This represents a 411.8~~394~~ ac.ft. per year enhancement to the Colorado River Basin. The predicted discharge under full extraction of 1.5 cfs (1086 ac-ft/yr) would be a 1041.8 ac-ft/yr enhancement. Water consumption by the Emery mine will not jeopardize the existence of or adversely modify the critical habitat of the Colorado River endangered fish species.

Inserted 5/05
Revised 2/07

CHAPTER IV ENGINEERING DESIGNS

IV.A UNDERGROUND MINE PLAN

This part covers the description of the underground mining operations to be conducted at the Emery Mine.

IV.A.1 UNDERGROUND MINE PLAN

UMC 783.12(a), 783.24(c),783.25(e), 783.25(h), 784.11(a), 784.23(a)

The permit area for the Emery Mine encompasses approximately 5,~~408~~568 acres. The boundary of the permit area is shown on the Permit Boundaries and Bonding map (Plate III-9). The description of the permit area is as follows:

Township 22 South, Range 6 East

Section 19: S/2NE/4, SE/4, E/2SW/4
Section 20: S/2NE/4, SE/4NW/4, S/2
Section 21: S/2N/2, S/2
Section 22: ~~SE/4, SW/4, SE/4NW/4, NE/4~~S/2, SW/4NW/4, portions of the following E/2SE/4NW/4, SW/4SE/4NW/4, S/2NW/4NE/4, SW/4NE/4, SW/4SW/4NE/4NE/4, W/2SE/4NE/4, S/2NE/4SE/4NE/4, SE/4SE/4NE/4
Section 23: portions of the following SW/4NW/4, NW/4SW/4~~W/2SW/4~~
Section 27: W/2, portion of NE/4
Section 28: All
Section 29: All
Section 30: E/2, E/2NW/4, SW/4NW/4, N/2NW/4SW/4, E/2SW/4
Section 31: N/2,W/2SW/4,E/2SE/4,SW/4SE/4
Section 32: All
Section 33: W/2,NE/4

Mining operations at the Emery Mine are conducted in the IJ Zone utilizing the room and pillar mining method. Plate IV-1 shows the layout, the present mine workings and the projected areas to be mined during the permit term. The existing workings have been marked to show the extent of underground mining operations (1) before August 3, 1977, (2) between August 3, 1977 and May 3, 1978, and (3) after May 3, 1978 up to the permit approval date of January 5, 1986. There are no surface mining operations at the Emery Mine. The projected mine workings are delineated by year for the next five year permit term. Plate IV-2 shows the same plan on a 1"=1000' map to show the extent of the projected life of mine plan in the IJ Zone. The Emery Mine operates under the General Safety Orders, Utah Coal Mines issued by the Industrial Commission of Utah and the applicable regulations issued by the Mine Health and Safety Administration (MSHA).

Access to the underground workings is through the portals shown on Plate II-1. All of the present portals are drift openings at the outcrop of the seam. These openings consist of intake, return, and belt entries. It may be necessary in the future to install ventilation raises in other areas of the property; however, these locations are not known at the present time. Future portals may consist of ramp excavations and shafts to access the coal seam. The new 4 East portal will use a ramp excavation down to the top of the IJ seam. A new set of portals will be installed for the southern main entries of the mine when production from the southern part of the mine warrants it.

V.B SUBSIDENCE

This part of Chapter V covers all of the issues associated with subsidence. Other chapters refer to this part when information concerning subsidence is required.

Refer to CHVI Section VI.A.4 (Water Uses, Water rights and Alternative Water Supply information) for a description of the approved water rights.

A comprehensive presubsidence survey of the permit area was done by Valley Engineering, Inc. and is appended to this part.

V.B.1 Subsidence Control, Monitoring and Mitigation

UMC 783.24 (d), (e), (h)

Plates V-1, V-2, and V-3, of Appendix V-3 (Presubsidence Survey) show the manmade features within and adjacent to the permit area, which are not associated with the mining operation. Each feature or structure is coded on the maps and described in the narrative. Plates II-l, II-2, IV-3, and IV-18, show the manmade structures associated with the mining operation. Each structure is coded on the maps and described in the narrative of Chapter II. The designs for the various structures are detailed in Chapters IV and VI.

UMC 784.16 (a)(l)(iv)

Past underground mining has taken place beneath three structures in this category. They are Pond #l (mine discharge sedimentation pond), Pond #4 (reverse osmosis discharge collection pond), and Pond #5 (preparation plant area sedimentation pond). A small amount of subsidence would not have a significant effect on these ponds.

Pond #1, the largest, is an incised structure with heavily rip-rapped berms and concrete inlet/outlet structures*

Pond #l is the only impoundment containing an appreciable amount of water and it is a large distance from any public or private structure. Any discharge would be to an unnamed tributary of Quitchupah Creek. All three impoundments overlie mains and submains entries with relatively shallow overburden depths (less than 200 ft) and thus subsidence is not likely. The potential for downstream material damage due to subsidence is very low.

UMC 784.20

Appendix V-3 contains a presubsidence survey, performed by Valley Engineering, Inc. in 1980. Since that time, no structures have been added or removed. This document is therefore still used as baseline information.

Since the presubsidence survey shows that subsidence could cause material damage to structures and renewable resource lands, the following information is included for Parts (a),(b),(c), and (d) of this regulation.

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A subsidence monitoring plan has been in place at Emery and contains the following features:

1. A series of reference points will be established outside the theoretical angle of draw for a particular area of mining.

1a. A mine representative will inspect monthly the surface area ~~overlying the~~ outlined on Plate V-5 as full extraction areas (planned subsidence)~~1st and 2nd south when partial~~ pillar splitting begins and continue until the survey monitoring points below indicate that there is no subsidence. A record of this inspection will be forwarded to the Division and kept at the mine office.

2. New reference points will be established as the area of mining increases to include old reference points.

3. Subsidence monitoring should, at a minimum, be established: a) at a point coincident to the geometric center of high extraction panels at least three months prior to mining activities beneath the station, and b) at periodic intervals over mains and sub mains at least three months prior mining activities beneath the stations.

4. New monitoring points established over partial pillar sections will be resurveyed within six months after final mining has taken place beneath them.

5. New monitoring points established over advancing sections such as mains and sub mains will be resurveyed within one year after mining has been completed beneath the station.

6. Monitoring points over partial pillar sections that have been resurveyed once and where no significant movement (".5') was found will be surveyed again within one year. If this subsequent survey shows no significant movement from the original survey, the point will be surveyed again at one year intervals. Points over advancing sections need not be resurveyed unless there has been evidence underground, (such as massive caving) that indicates subsidence may have taken place above them. If these sections have been abandoned, resurveys shall take place every two years.

   This program will remain in effect during the permit term (5 years), after which it will be reevaluated and modified if necessary to reflect the data collected to that point.

7. If a resurveyed point does demonstrate significant movement, the Division shall be notified of the survey discrepancies, and the point resurveyed at six-month intervals until no movement is indicated. Subsequent surveys will then take place as indicated in item 6.

8. When a new point is installed it shall be surveyed (the "Initial survey"), into a closed loop containing at least one "reference point", or any other point, (not located over high extraction areas) that is "linked" to a reference point, and has been surveyed within 6 months prior and no movement found. The initial survey should Consist of a horizontal traverse having a closure of at least 1:10,000 and a vertical traverse having a closure of at least 0.10 feet.

9. Resurveys of a point should consist of a vertical traverse having a closure of at least 0.50 feet. If significant movement is detected, (±.5'), a horizontal survey to that point will also be performed to check horizontal movement. The horizontal check survey may consist of a "side shot" where angles and distance are double checked, and need not be a closed traverse.

10. Monitoring points will consist of a concrete base and brass cap installed according to Figure V-8.

Plate V-5 shows the existing and future monitoring points for the permit area.

Consol will provide 3 copies of a subsidence monitoring report to DOGM within one month after completion of any subsidence monitoring field survey conducted pursuant to the approved subsidence control plan. Subsidence monitoring reports shall contain the following information:

1. Mine maps showing where pillars have been pulled and the month and year that such pillars were removed or partially removed.

2. Maps showing the location of survey monitoring stations and tension cracks and/or compression features visible on the surface.

2a. The subsidence monitoring points above the areas outlined on Plate V-5 as full extraction areas (planned subsidence) ~~1st South panel~~ will have photographs recorded both pre subsidence and post subsidence.

3. The differential level and horizontal survey summary.

4. Brief narrative explaining any "significant movement" and any action the applicant has taken to mitigate the effects of such movement or any tension or compression features visible on the surface.

11. Consol will establish pre-mining elevations and gradients of any irrigation ditches and pond embankments within the angle of draw. Consol will monitor these areas by visual inspection and post –subsidence ground survey, to establish the effects of subsidence. Mitigation of these effects will be carried out per the following section.

12. Consol will provide the Division a quarterly subsidence mitigation report that describes the surface mitigation projects and their status broke down by surface land owner.

13. Consol will update the existing Pre subsidence survey and Plates six (6) months prior to full extraction and provide copies to the surface land owner, DOGM, and the water conservancy, per R645-301-525-130.

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UMC 817.124

Consol will meet the commitments made in response to UMC 784,20(c). In the past, Consol has both repaired subsidence effects and provided compensation through replacement of lost production This was done for an actively flood-irrigated field owned by J. Lewis in the SW1/4 of Section 29, T22S, R6E.

Consol will repair or replace any adversely affected State appropriated water supplies that are contaminated, diminished or interrupted.

A wetland mitigation plan will be implemented in areas where jurisdictional wetlands are identified in areas where planned subsidence is contemplated per CH V, Plate V-5 (Subsidence Monitoring Points and Buffer Zones). Prior to subsidence, Consol will invite representatives from Consol , DOGM and COE, to assess the existence of and possible impacts to wetlands as a result of the subsidence. This team will then formulate a wetland mitigation plan to mitigate for the impacts on a site by site approach.

The landowner's wishes will be considered during the design of any mitigation plan and the plan will be discussed with the landowner prior to implementation. A good faith effort will be made to accommodate the landowner's wishes during both the design and construction phase of the mitigation plan. Permission will be obtained prior to entering onto areas which Consol has not obtained legal access and surface rights.

The timing of the implementation of a mitigation plan is influenced by several factors. Rather than establish an inflexible timetable to be used in all cases, it is preferable to establish a list of items to be considered on a case by case basis to arrive at a time table which maximizes the benefits of the mitigation plan for the landowner, maximizes the chances of a successful mitigation plan and minimizes inconvenience to the landowner both from the standpoint of needless repetitions of repair work and unnecessary delays in implementation of the mitigation plan.

Factors to be considered:

1. The effect of the subsidence on the landowner - In most cases it will be necessary to weigh the benefits of prompt mitigation against the inconveniences of needless repetition of mitigation. For instance, if subsidence should prevent flow through an irrigation ditch which is not scheduled for use again for 5 years, it would be preferable to wait on repair work until the construction season prior to when the ditch will next be used than inconvenience the landowner by per-forming repair work the year it is noticed and each year thereafter if subsidence should continue. However, if subsidence occurs which prevents flow through a ditch that is used each summer, then it will be necessary to repair the ditch as soon as practical even though future subsidence may necessitate further work.

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2. The effect of the weather on mitigation plans - In some cases, it may be practical to perform repair work in the winter or spring while in other cases it would not. For instance, it would probably not be practical to repair a road embankment, where compaction is critical, during winter weather. However it may be practical to repair a fence. Another example would be if it was necessary to remove and stockpile topsoil to perform mitigation work. It would be better to perform the work in the summer when the soil could be properly segregated than to try to do the work in the spring when conditions are normally muddy.
3. The effects of mitigation work on non-renewable resources -The best example of this situation is the case where it is necessary to regrade an area to mitigate the effects of subsidence. If it is necessary to remove the topsoil prior to regrading, it would be better to wait until all probable subsidence had occurred than to risk topsoil contamination through repeated removal and respreading of the topsoil should subsidence continue for several years. However in this case, it may be necessary to perform lesser or temporary mitigative work to minimize the effects of pending water on the soil resources or hazardous conditions for people, wildlife or livestock.

As discussed above, we do not believe it is possible to commit to a specific timetable for performing subsidence mitigation. However, when subsidence mitigation is required by applicable laws and regulations, mitigation will be performed as soon as practical taking into consideration the above items.

UMC 817.126

As described in the subsidence control plan, under UMC 784.20, the two (2) perennial streams in the permit area will be protected by buffer zones (Refer to Plate V-5). There are no impoundments of 20 acre-feet or more in the permit area.

Underground water rights described in Chapter VI, under UMC 784.14, show that the Town of Emery maintains two (2) wells developed in different aquifers within the Ferron Sandstone formation. These wells are used as a backup water source to the town's present water supply system which relies on surface water from Muddy Creek. Emery Town Well No. 1 is developed in the Lower Ferron aquifer, which lies well below current mining activities. Well No. 2 is developed in the Middle and Upper Ferron aquifers which are directly below and above the seam being mined. No adverse impacts to either well are anticipated since the wells are located about 3 to 4 miles from the mine and are up gradient within the regional ground water flow pattern. Static water level readings taken from wells maintained as part of the mine's ground water monitoring program also indicate that no disruption of the aquifers in the vicinity of the town's wells has occurred.

Underground operations at the Emery MIne are not conducted beneath or in close proximity to any public buildings, including churches, schools, hospitals, court houses, and government offices.

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VI.A.7 PROBABLE HYDROLOGIC CONSEQUENCES

This section addresses the probable hydrologic consequences of coal mining and reclamation operations in the mine permit and adjacent areas. Mitigating measures are discussed generally in this section and in detail elsewhere in Chapter VI of the MRP.

VI.A.7.1 Potential Impacts to Surface and Groundwater

The following potential impacts of coal mining on the quality and quantity of surface and groundwater flow within and adjacent to the Emery Mine permit area were evaluated:

- Contamination from acid- or toxic-forming materials;
- Increased sediment yield from disturbed areas;
- Impacts to groundwater availability;
- Impacts to surface water availability;
- Increased total dissolved solids concentrations in surface and groundwater;
- Flooding or streamflow alteration;
- Hydrocarbon contamination from above ground storage tanks or from the use of hydrocarbons in the permit area; and
- Contamination of surface water from coal spillage due to hauling operations.

These potential impacts are addressed in the following sections of this MRP.

VI.A.7.2 Baseline Hydrologic and Geologic Information

Baseline geologic information is presented in Chapter V of this MRP. Baseline hydrologic information is presented in Sections VI.A.1 through VI.A.3 of this MRP.

VI.A.7.3 PHC Determination

Potential impacts to the hydrologic balance are addressed below.

Contamination from Acid- or Toxic-Forming Materials. Information concerning acid-and toxic-forming materials in rock at the Emery Mine is presented in Sections V.A.4 through V.A.6 of the MRP. As noted, the pH of roof and floor materials ranges from 5.0 to 9.1, with the acid-base potential indicating a net base potential. The alkaline nature of the system is further indicated by the fact that the pH of groundwater in the area is typically in the range of 7.0 to 9.5 (see Section V.A.2.7).

Except near outcrops, the electrical conductivity of the rock is generally low. However, naturally-occurring sodium adsorption ratios and exchangeable sodium percentages of the rock are moderately high. As a result, sodium adsorption ratios calculated from the data presented in Table VI-9 suggest that groundwater discharged from the mine may have a low to medium sodium hazard if that water is used for irrigation without further treatment. Analyses of rock samples presented in Section V.A.4 indicate that concentrations of trace elements are generally sufficiently low that the rock can be considered non toxic-forming. Thus, with the exception of moderate sodium concentrations in some samples, analytical data obtained from the local rock and mine-water discharges indicate that no significant potential exists for the contamination of surface and groundwater in the permit and adjacent areas by acid- or toxic-forming materials.

Increased Sediment Yield from Disturbed Areas. Mining and reclamation at the Emery Mine has the potential to increase sediment concentrations in the surface waters downstream from disturbed areas. However, sediment-control measures such as sedimentation ponds, diversions, etc. have been installed to minimize this impact. These facilities have been designed to meet applicable regulatory requirements and are regularly inspected and maintained to ensure that they continue to meet those standards (see Section VI.B).

Information contained in the Utah Division of Oil, Gas and Mining water-quality database indicates that water has never discharged from the Emery sedimentation ponds, with over 500 no-flow observations recorded for these ponds. Thus, these sediment-control measures at the mine are effective at minimizing sediment yields to adjacent streams.

Impacts to Groundwater Availability. As noted previously in this chapter, coal at the Emery Mine occurs in the Ferron Sandstone Member of the Mancos Shale. For the purposes of this MRP, the Ferron Sandstone Member has been divided into three units (see Section VI.A.2): the upper Ferron Sandstone, Kmf(u); the middle Ferron Sandstone, Kmf(m); and the lower Ferron Sandstone, Kmf(l). In the upper Ferron, sandstones are lenticular, channel-shaped bodies that are generally less than 40 feet thick. These channel sandstones are characterized by unidirectional cross-stratification, fining-upward cycles, and lateral interfingering with mudstones. The middle and lower Ferron consists of thin-bedded sandstone and shale at the base that grade upward to thick, cliff-forming sandstones.

The Ferron Sandstone lies between and intertongues with marine shales in the Tununk and Blue Gate Members of the Mancos Shale. The Blue Gate Member unconformably overlies the Ferron and is composed primarily of gray bentonitic, calcareous shale. The Tununk Member is lithologically similar to the Blue Gate Member.

The Ferron Sandstone outcrops in a series of prominent cliffs along the eastern edge of the Emery coal field and dips 2 to 10° to the northwest beneath the ground surface. The continuity of the Ferron is broken in the subsurface by the Joes Valley-Paradise fault zone, which exists immediately northwest of the permit area. This fault zone extends for about 60 miles northeast and 20 miles southwest of the mine area[1]. A comparison of Plate VI-4 with Plates V-19 through V-22 indicates that the Emery Mine usually operates within the saturated zone, except along the outcrop to the east and where water levels have been locally altered due to mining activities.

Morrissey et al. (1980) indicate that recharge to the Ferron aquifer originates in the Wasatch Plateau west of the Emery Mine and discharges to the southeast along the Joes Valley-Paradise fault zone. Hence, this fault zone effectively acts as a linear source of groundwater recharge to the Ferron Sandstone. The contribution of precipitation to direct recharge of the Ferron Sandstone overlying the mine is probably small, since precipitation in this area is low (averaging about 8 inches annually) and the area is overlain by the relatively impermeable Blue Gate Member of the Mancos Shale. Currently, water is discharged from the Ferron aquifer in the region by mining operations, wells, leakage along streams, and springs.

Mining within the Emery Mine has locally changed the pattern of ground water flow near the mine, and part of the upper section of the Ferron Sandstone aquifer has experienced water-

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[1] Hintze, L.F. 1980. Geologic Map of Utah. Utah Geological and Mineral Survey. Salt Lake City, Utah.

level declines (see Plate VI-4). As mining has progressed, the mine has intercepted more and more ground water and caused a cone of depression near the northwest corner of mined area.

Groundwater has the potential to enter the Emery Mine through both the floor and roof from permeable, saturated sandstones. Hydrographs of water-level data collected from monitoring wells at the mine (Figures VI-6 through VI-9) show that water level declines have been experienced in all three sections of the Ferron aquifer and also in the Blue Gate shale. However, the hydrographs indicate that the primary source of inflow to the mine is primarily from the upper Ferron aquifer (Kmf[u]). Significant upward leakage from the middle Ferron (Kmf[m]) is impeded by shales that constitute the floor of the mine. In-mine observations have verified that most inflow to the mine occurs from the roof rather than the floor.

As water flows into the mine, the flow pattern within the Ferron Sandstone aquifer is altered. These conditions in turn induce groundwater level declines in the area. Since the principal avenue of inflow to the mine is through the roof of the workings, the upper portion of the Ferron Sandstone is most subject to water level declines.

Average discharge from the Emery Mine during the period of 1979 through 2005 is shown in Figure VI-20A (see also Appendix VI-9). No data are available for the years prior to 1979. Discharge from the mine continued through a period of temporary shutdown (1991 through 2001) when Consol pumped water to maintain the mine in an accessible condition. Since pillars were pulled prior to the 1991 temporary shutdown, the mine-water discharge during this period is representative of full-extraction, post-subsidence conditions.

A mass balance approach was used to predict future groundwater inflow to and discharge from the mine, under full-extraction conditions. The water balance equation used for this analysis is:

Outflow = Inflow + Change in storage

Given the probable lack of substantial direct recharge from precipitation to the Ferron Sandstone in the mine area, subsurface inflow occurs predominantly from groundwater that flows from the Joes Valley-Paradise fault zone into the Ferron Sandstone and then toward the mine. Outflow occurs when groundwater is either pumped from the mine or used underground for various purposes (i.e., dust suppression, equipment cooling, etc.) and then removed from the mine as moisture in the coal or in the mine air.

Groundwater inflow to the mine occurs either horizontally (due to the mine being within the flow path) or vertically (due to gravity drainage from the overlying sandstone into the mine void). In a study by the U.S. Geological Survey of the Emery Mine area, Lines (1987)[2] found that "prior to mining, the vertical component of flow was upward from the Ferron into the Blue Gate Member. As mining progressed, ground-water flow was directed toward the mine workings, and much of the aquifer and other rocks above the mined coal bed were dewatered. The steady-state pattern of [predominantly horizontal] flow . . . probably would not develop unless mining ceased and dewatering of the mine continued for several years." These conditions are depicted on Figure VI-20B.

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[2] Lines, G.C. 1987. Ground-Water Study 11. pp. 365-396 *in* Ground-Water Information Manual: Coal Mine Permit Applications – Volume II. U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement. Available online at http://www.ott.wrcc.osmre.gov/library/hbmanual/grdh20info/OSM-GWInfoManual-II-11.pdf

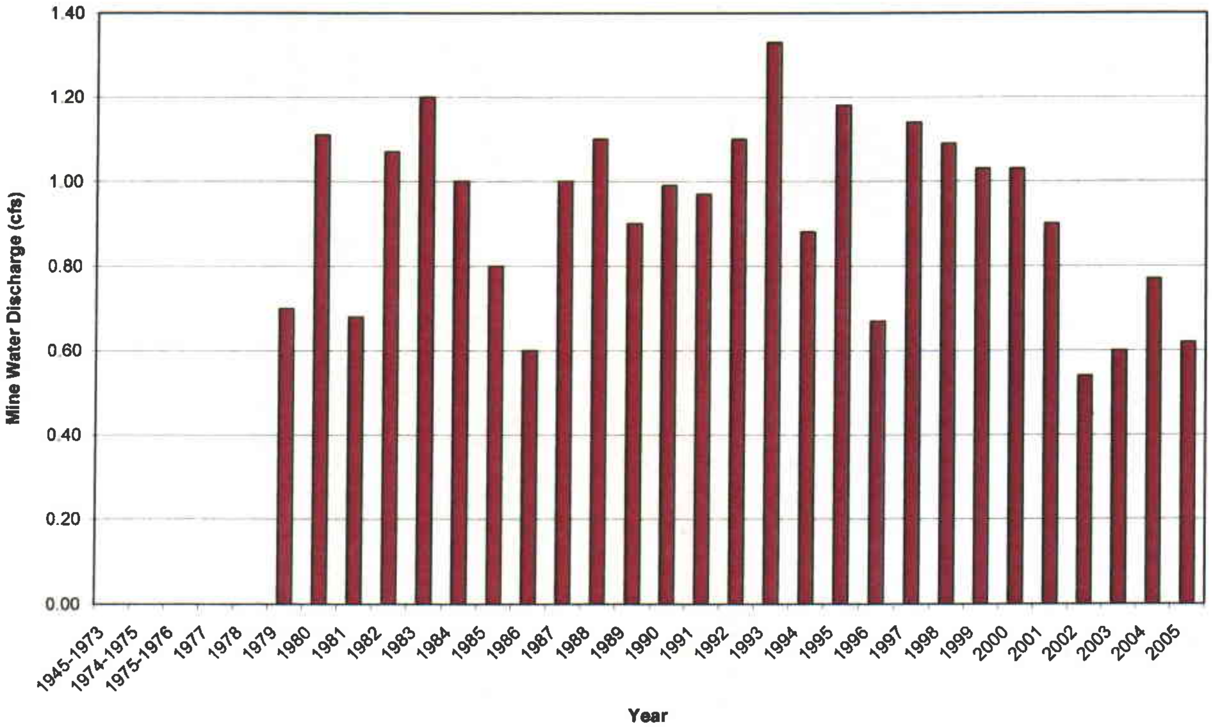

Figure VI-20A. Average Mine Water Discharge By Year

For the sake of this analysis, it was assumed that the steady state condition identified in Figure VI-20B(c) was reached during the several-year shutdown period of 1991 through 2001. Under this condition and assuming no substantial change in underground water storage in the mine during the shutdown, water discharged from the mine during this period would equal the amount of predominantly horizontal inflow to the mine. Data contained in Appendix VI-9 indicate that discharge from (and therefore horizontal inflow to) the mine during the shutdown period averaged 1.03 cfs. Since groundwater flows horizontally out of the Joes Valley-Paradise Fault Zone toward the mine, the amount of water flowing into the mine would be a function of the length of mine workings parallel (i.e., exposed) to the fault zone. During the temporary shutdown, this length was 2.17 miles (see Plate VI-6A), resulting in a ratio of horizontal inflow per unit length of mine exposed to the groundwater flow path of 0.47 cfs/mi. This value was used to predict future quantities of horizontal inflow to the mine as the mine expands.

Following the restart of mining in 2002, some groundwater encountered in the mine was used underground by the mining equipment. The quantity of water used underground was assumed to equal the difference between the mine-water discharge during the period of inactivity (1.03 cfs) and the mine-water discharge following the restart of mining (averaging 0.63 cfs from 2002 through 2005 – see Appendix VI-9). Since full extraction was not occurring during this period, the difference would be indicative of in-mine usage only (i.e. not influenced by increased inflows due to mine subsidence). Hence, in-mine water usage averaged 0.40 cfs from 2002 through 2005. With an average annual mined area of 18.1 acres from 2002 to 2005 (see Plate VI-6A), in-mine water usage is estimated to be 0.022 cfs/acre under current operational conditions. This value was used to predict future quantities of in-mine water usage as the mine expands.

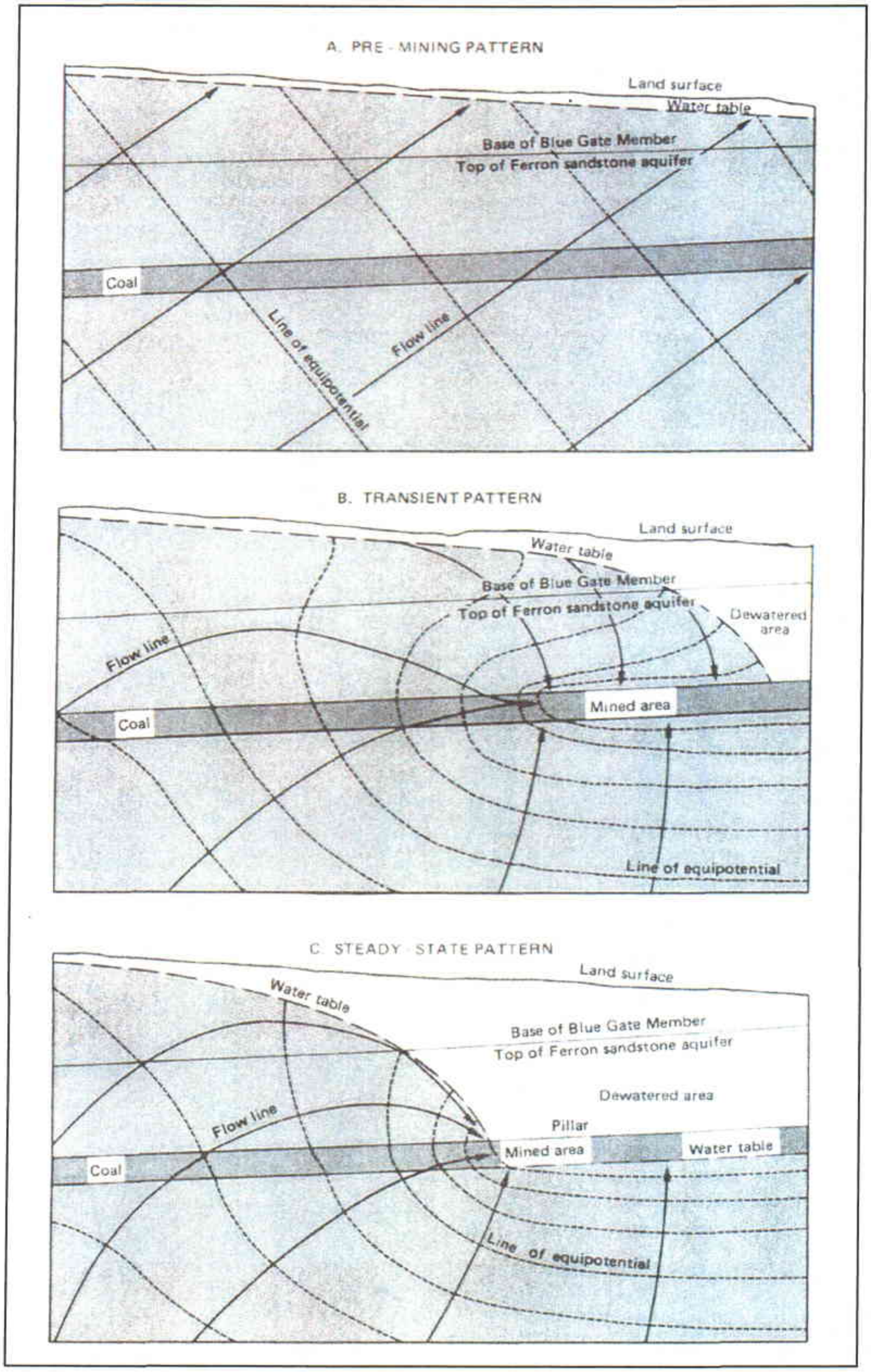

Figure VI-20B. Approximate Pre-mining, Transient, and Steady-state groundwater flow around the Emery Mine (from Lines, 1987)

Although vertical inflow to the mine is likely limited in areas that were mined prior to 1991 (due to the development of steady-state conditions noted in Figure VI-20B(c)), a condition more like Figure VI-20B(b) has probably existed in areas mined since 2002 (i.e., components of both vertical and horizontal inflow as the mine expands unto areas where the groundwater has not yet reached static equilibrium). Under these conditions, it was necessary to estimate the vertical component of inflow to the mine. This was accomplished using two analytical methods, assuming full-extraction conditions, and then comparing the results to pre-1991 conditions to determine the method that most accurately predicts conditions at the mine site.

Each method is limited in its application to simplified flow situations, assuming that the aquifer is of infinite areal extent with uniform thickness. The first method used to estimate vertical mine-water inflow was the tunnel inflow equation presented by Freeze and Cherry (1979)[3]. This method assumes that the mine acts as an infinitely long tunnel in a homogeneous, isotropic porous medium. Under this assumption, the rate of ground water inflow Q_o per unit length of mine can be calculated using the following equation:

$$Q_o = \frac{2\pi K H_o}{2.3\log(2H_o / r)}$$

where r is the mine radius, H_o is the depth from the potentiometric surface to the center of the mine, and K is the hydraulic conductivity, with all units being compatible.

The second method used to estimate vertical mine-water inflow was the Hantush equation presented by Singh and Atkins (1985)[4]. This equation, which assumes that the aquifer is homogeneous, isotropic, and pumped at a constant rate, is applied to large underground openings as illustrated in Figure VI-20C. Inflow to the mine is calculated by:

$$Q = 2\pi TDG(\lambda, r/B)$$

$$\lambda = Tt / r^2 S$$

$$r/B = r(K'/KLL')^{\frac{1}{2}}$$

where B is the leakage factor; D is drawdown to a level H from the original head H_o; $G(\lambda, r/B)$ is the Hantush well function; K is the aquifer hydraulic conductivity; K' is the aquitard hydraulic conductivity; L is the thickness of the formation being dewatered; L' is the aquitard thickness, Q is the quantity of inflow; r is the radius at which drawdown occurs; and t is elapsed time, with all units being compatible.

Vertical inflow to the mine was estimated using the two methods described above for the period of 1980 through 1990 when Figure VI-20B(b) was again assumed to represent mine hydrologic conditions (i.e., prior to attaining steady-state conditions during the temporary shutdown). Assuming no change in water storage in the mine (i.e., discharge is equal to inflow), and accounting for lateral groundwater inflow and in-mine water usage as outlined above, these calculations were then compared with measured discharge rates during the same period.

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[3] Freeze, R.A. and J.A. Cherry. 1979. Groundwater. Prentice-Hall, Inc. Englewood Cliffs, New Jersey.

[4] Singh, R.N. and A.S. Atkins. 1985. Analytical Techniques for the Estimation of Mine Water Inflow. International Journal of Mining Engineering. Vol. 3, pp. 65-77.

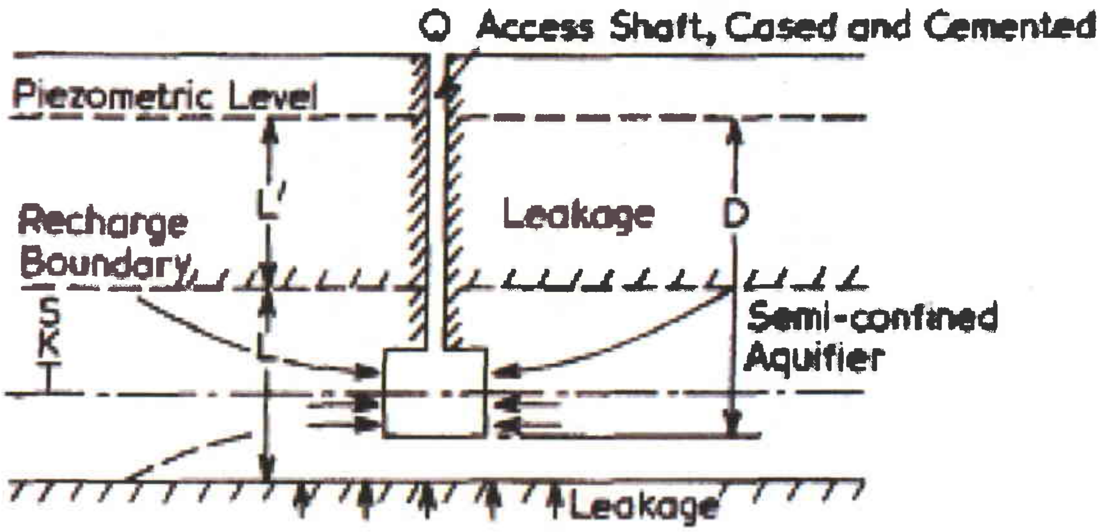

FIGURE VI-20C. Conceptual Hantush Flow Model (from Singh and Atkins, 1985).

Based on these calculations, the best approach for estimating future conditions was selected.

Preliminary calculations using the two methods indicated that the Hantush equation was a much better predictor of vertical mine-water inflow than was the tunnel inflow equation. To more accurately predict inflow, the average post-subsidence hydraulic conductivity of the aquifer was therefore derived by calibration using the Hantush equation, attempting to mimic measured discharge rates as closely as possible. The average hydraulic conductivity of the Ferron Sandstone overlying the coal seam was thereby determined to be 0.20 ft/day. This value compares well with aquifer data presented previously in this chapter and independent data presented by Lines et al. (1983).[5] Assuming an aquifer thickness of 400 feet (based on a review of Plate V-20), the transmissivity data presented in Table VI-4 of this MRP convert to hydraulic conductivities ranging from 0.01 to 1.9 ft/day and averaging 0.9 ft/day. Laboratory hydraulic conductivity data provided by Lines et al. (1983) ranged from 2.6×10^{-6} to 0.77 ft/day, averaging 0.11 ft/day in the horizontal direction and 0.076 ft/day in the vertical direction. Hydraulic conductivities derived from field tests summarized by Lines et al. (1983) ranged from 0.025 to 2.0 ft/day, averaging 0.55 ft/day (again assuming an aquifer thickness of 400 feet).

Results of the mine-water inflow/discharge calculations for the period of 1980 through 1990, using the Hantush and tunnel inflow equations, are summarized in Table VI-23A and detailed in Appendix VI-9. Each set of calculations accounted for lateral groundwater inflow and in-mine water usage, and assumed that no change in underground water storage occurred (i.e., that discharge was equal to inflow). The equations were able to account for less inflow as the mine expanded since vertical inflow was assumed to enter the mine only in the area of current mining. As indicated in Table VI-23A and Figure VI-20D, the Hantush equation provides a

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[5] Lines, G.C., D.J. Morrisey, T.A. Ryder, and R.H. Fuller. 1983. Hydrology of the Ferron Sandstone Aquifer and Effects of Proposed Surface-Coal Mining in Castle Valley, Utah. U.S. Geological Survey Water-Supply Paper 2195. Alexandria, Virginia.

reasonable estimate of mine water discharge. Hence, this equation was used to predict future mine-water discharge rates, again assuming post-subsidence conditions.

Table VI-23A. Estimated mine-water discharge rates using two analytical methods

Year	Mine-Water Discharge Rate (cfs)		
	Measured discharge	Hantush inflow equation	Tunnel inflow equation
1980	1.11	1.05	11.38
1981	0.68	0.96	1.38
1982	1.07	1.04	7.42
1983	1.20	1.08	1.98
1984	1.00	0.98	2.13
1985	0.80	0.66	7.60
1986	0.60	0.79	1.67
1987	1.00	1.09	2.95
1988	1.10	1.03	7.13
1989	0.90	0.95	12.10
1990	0.99	1.07	2.47
Average	0.95	0.97	5.29

Predicted mine-water inflow/discharge rates through the period of the current mine plan (2013) are summarized in Table VI-23B, based on the Hantush equation and accounting for mine-water inflow and usage as described above. These calculations again assume that no substantial change in underground water storage will occur during the period of evaluation (i.e., discharge is equal to inflow). Spreadsheets detailing these calculations are provided in Appendix VI-9. Based on these calculations, discharge rates are expected to average 1.50 cfs, ranging from about 1.2 to 2.0 cfs during the calculation period. Variations in discharge rates are anticipated depending on the depth of mining below the potentiometric surface and the area over which mining will occur. These estimates are based on the assumed hydraulic conductivity of 0.20 ft/day (i.e., the calibrated value arrived at in the comparison with measured historic discharge rates). Since pillars had been pulled prior to the 1991 temporary shutdown, this hydraulic conductivity is assumed to be representative of average post-subsidence conditions. Hence, the estimates presented in Table VI-23B assume full extraction of the coal.

Inflow of water to and discharge of water from the mine will continue to influence the shape of the potentiometric surface in the vicinity of the mine. As a result, it is anticipated that the cone of depression noted on Plate VI-4 will change as mining continues. Consol is currently modeling groundwater in the permit and adjacent areas, using the software package MODFLOW, to predict future water-level declines due to mining. The results of this modeling effort will be provided to UDOGM when available.

It is anticipated that the modeling effort will predict future groundwater conditions similar to those that have been measured in the past within the permit and adjacent areas. Figure VI-6 of the approved MRP provides hydrographs of water-level data collected from monitoring wells completed within the Emery Mine permit area in the Bluegate Shale. As indicated, no declines

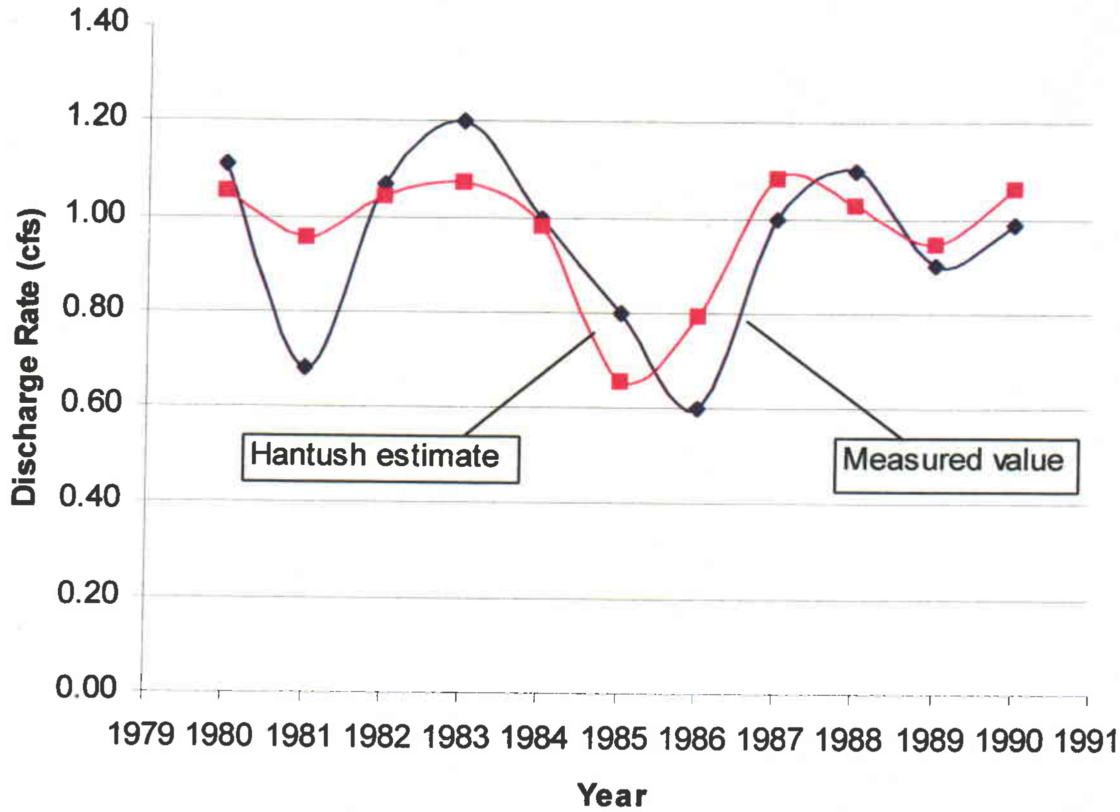

Figure VI-20D. Comparison of measured and calculated mine discharge data (Hantush equation)

Table VI-23B. Predicted mine water discharge rates

Year	Predicted Discharge (cfs)
2006	1.29
2007	1.19
2008	1.33
2009	1.77
2010	1.28
2011	1.52
2012	1.63
2013	1.98
Average	1.50

in water levels occurred during the period of record presented in that figure. In contrast, hydrographs that were prepared using data collected from wells completed in the upper Ferron Sandstone (Figure VI-7 of the approved MRP) show declines in groundwater levels during the period of record. Similar conditions are expected in the future (i.e., no substantial influence on groundwater levels in the Bluegate Shale but declining water levels in the upper Ferron Sandstone). Based on prior data presented in Section VI.A.2.4 of the MRP, gradual declines in groundwater levels may be experienced in the middle Ferron Sandstone in the future, while no substantial changes in water levels would be anticipated in the lower Ferron Sandstone.

Impacts to Surface Water Availability. Water removed from the mine will be discharged to Quitchupah Creek, increasing the flow of this receiving stream. Only limited streamflow data are available for Quitchupah Creek, with the U.S. Geological Survey maintaining a gaging station near the mine office from July 1978 through September 1981. The average annual flow of Quitchupah Creek at this location for the three complete water years of record was 8.43 cfs, ranging from 6.73 to 10.8 cfs (data obtained from http://waterdata.usgs.gov/nwis). As indicated in Table VI-23B, mine-water discharge rates are expected to average 1.50 cfs through 2013. This represents an 18% increase in the above-noted average annual flow of Quitchupah Creek.

As noted above, no water has been observed to discharge from the Emery Mine sedimentation ponds. Hence, a small quantity of runoff is precluded from reaching Quitchupah Creek that would discharge to this stream if the mine surface facilities were not present. Given the small amount of precipitation in the area and the relatively small area of the surface facilities, this reduction in the streamflow of Quitchupah Creek is likely minimal. Thus, the net effect of mining on the availability of surface water in the immediate area is an increase in the flow of Quitchupah Creek and downstream waters.

According to Section VI.A.3 of the approved MRP, streamflow in Christiansen Wash and Quitchupah Creek in the permit and adjacent areas is influenced by several factors, including direct irrigation return flow of water that originated in Muddy Creek, groundwater discharge from the Ferron Sandstone aquifer, discharge from the Emery Mine, and overland flow from precipitation runoff. Page 101 of Chapter VI notes that "the complexity of the surface water hydrology of both Christiansen Wash and Quitchupah Creek" makes it "extremely difficult to determine the relative contributions to streamflow of the various influences." Hence, although it is assumed that interception of water in the mine will locally decrease base flow in Christiansen Wash and Quitchupah Creek, the magnitude of this impact cannot be accurately predicted.

It should be noted that the discharge of mine water to Quitchupah Creek probably results only in a local increase in flow and not a basin-wide increase. As discussed above, the coal being mined at this location occurs in the Ferron Sandstone Member of the Mancos Shale, which is underlain by the Tununk Shale member of the same formation. The shales of this formation have a low permeability[6], thus forcing groundwater to the surface as streamflow. As a result, although the discharge of water from the mine results in a local loss of groundwater and gain in surface water, this discharge does not disrupt the hydrologic balance of the basin.

Given this condition, the only actual loss of groundwater from the hydrologic balance is that water which is contained in the coal and leaves the basin upon mining or is discharged from the mine in

[6] Waddell, K.M., P.K. Contrato, C.T. Sumsion, and J.R. Butler. 1981. Hydrologic Reconnaissance of the Wasatch Plateau-Book Cliffs Coal-Fields Area, Utah. U.S. Geological Survey Water-Supply Paper 2068. Washington, D.C.

the ventilation air. These quantities are estimated in Section II.C, subsection UMC 817.97 of this MRP.

As indicated on Plate V-5, buffer zones have been established to preclude full-extraction mining in the future beneath Christiansen Wash and Quitchupah Creek. Hence, direct impacts to the streambed of these two surface waters are not anticipated. However, subsidence may influence irrigation ditches and stock-watering ponds in areas overlying full-extraction panels. Impacts to irrigation ditches may include the development depressions that cause ponding in areas that would otherwise be free draining. Cracks may also develop in ditch and pond embankments, resulting in seepage outside of the embankments to adjacent ground.

Two conditions make it doubtful that substantial water will be diverted from an irrigation ditch or stock-water pond to the mine as a result of subsidence. First, the Blue Gate member of the Mancos Shale, which exists between the surface and the coal zone throughout the area, contains bentonitic clays.[7] As a result, subsurface cracks will swell and seal when water enters the crack. Second, irrigation ditches and ponds in the area typically contain water only ephemerally, minimizing the time that surface water may come into contact with a crack. Monitoring and mitigation of subsidence impacts, if they occur, will be in accordance with the plan presented in Section V.B.1 of the approved MRP.

Increased Total Dissolved Solids Concentrations in Surface and Groundwater. Data summarized in Table VI-9 of this MRP indicate that the average TDS concentration of water entering the mine (as measured in roof samples) is 1025 mg/l. Assuming that the equivalent-weight bicarbonate concentration can be calculated by balancing the anions and cations in that table, the roof inflow is a sodium-bicarbonate water with an average sulfate concentration of 264 mg/l. The average TDS concentration of water discharging from the mine to Quitchupah Creek (as measured at Ponds 1 and 6 and reported in Table VI-9) is 2390 mg/l. This is a sodium-sulfate water with an average sulfate concentration of 1340 mg/l.

These data indicate that the TDS concentration of water flowing through the mine increases by a factor of approximately 2.3. The sulfate concentration of this water increases by a factor of about 5.1. Furthermore, the ratio of calcium to sodium increases as the water flows through the mine. This increase in TDS and sulfate concentrations is probably the result of dissolution of rock dust used in the mine.

The impact of the TDS and sulfate concentration increases on surface-water resources in the permit and adjacent areas is considered minimal for two reasons. First, surface water in the permit and adjacent areas has been classified in the Utah Division of Water Quality *Standards of Quality for Waters of the State* (R317-2) as Class 2B (protected for secondary contact recreation such as boating, wading, or similar uses), Class 3C (protected for non-game fish and other aquatic life, including the necessary aquatic organisms in their food chain), and Class 4 water (protected for agricultural uses including irrigation of crops and stock watering). No sulfate discharge standard exists for any of these three classifications. The TDS standard for Quitchupah Creek is 2600 mg/l, which is greater than the average concentration presented above. Consol operates under a UPDES discharge permit issued by the Utah Division of Water Quality and controls discharges from the mine to be consistent with that permit.

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[7] U.S. Geological Survey. National Geologic Map Database. Citation. Mancos. http://ngmdb.usgs.gov/Geolex/Refsmry/sumry_9165.html. Site accessed 27 Feb 2007.

Second, except where overlain by a thin veneer of alluvial deposits, surface water in Quitchupah Creek flows across the Tununk Member of the Mancos Shale immediately downstream from the mine permit area. Since this member is a gypsiferous formation, sulfate and TDS concentrations increase naturally in surface water that flows across areas underlain by this unit. Thus, the additional input of these constituents from the mine waters to local streams is considered minimal.

A TMDL study of the Muddy Creek watershed[8] (of which Quitchupah Creek is a tributary) indicated that Muddy Creek and its major tributaries (including Quitchupah Creek) would not support an agricultural beneficial use classification. This lack of beneficial-use support occurs at the location where these streams cross State Highway 10 (i.e., upstream from the mine water discharge point). The study concluded that elevated TDS concentrations in areas downstream from Highway 10 are caused predominantly by changes in surficial geology (i.e., outcropping of the saline Mancos Shale) and irrigated agriculture (i.e., return flows).

According to the U.S. Bureau of Reclamation[9], the salt load from the Muddy Creek watershed averages 86,000 tons/yr. The Emery Mine UPDES permit currently allows a maximum salt load of 12 tons/day to be discharged from the mine. Assuming that this load is discharged constantly throughout the year, the annual salt load from the mine to the Muddy Creek watershed would be 4380 tons/yr (about 5% of the basin-wide salt load). The UPDES permit indicates that the salt-load limit will change to 3839 tons/yr (rather than 12 tons/day) following EPA approval of the TMDL loading limit. Once this new limit is adopted, the salt load from the Emery mine will represent about 4.5% of the annual salt load of the Muddy Creek watershed.

As indicated in Section VI.A.4, no surface-water rights exist on Quitchupah Creek downstream from the mine-water discharge point, nor do they exist on Ivie creek between the confluence of Quitchupah Creek and Muddy Creek. Hence, no substantial water-quality impact to downstream water users is anticipated.

In the post-mining situation, there is a potential for water-quality degradation within the upper Ferron as groundwater flows through previously mined areas and then into adjacent un-mined rock. However, it is expected that this condition will be tempered by the dilution effect of better-quality recharge water entering the area from the west. As far as the middle and lower Ferron are concerned, a fairly uniform shale floor impedes downward seepage of mine water to lower zones. Thus, groundwater quality in these lower sections of the Ferron should not be substantially affected either during or after mining.

Flooding or Streamflow Alteration. Runoff from all disturbed areas flows through sedimentation ponds or other sediment-control devices prior to discharge to adjacent undisturbed drainages. Three factors indicate that these sediment-control devices minimize or preclude flooding impacts to downstream areas as a result of mining operations:

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[8] MFG, Inc. 2004. Price River, San Rafael River, and Muddy Creek TMDLs for Total Dissolved Solids, West Colorado Watershed Management Unit, Utah. Report prepared for the Utah Division of Water Quality. Fort Collins, Colorado.

[9] U.S. Bureau of reclamation. 2003. Quality of Water, Colorado River Basin. Progress Report No. 21. Washington, D.C.

1. The sediment-control facilities have been designed and constructed to be geotechnically stable. Thus, no substantial potential exists for breaches of the sediment-control devices to occur that could cause downstream flooding.
2. These sediment-control devices are sized sufficiently that no discharges have been recorded. This precludes flooding impacts to downstream areas.
3. By retaining sediment on site in the sediment-control devices, the bottom elevations of stream channels downstream from the disturbed areas are not artificially raised. Thus, the hydraulic capacity of the streams channels is not altered and flooding potential is further precluded.

Following reclamation, stream channels will be returned to a stable state. The reclamation channels have been designed in accordance with the requirements of UDOGM. Thus, flooding in the reclaimed areas will be precluded. Interim sediment-control measures and maintenance of the reclaimed areas during the post-mining period will preclude deposition of significant amounts of sediment in downstream channels following reclamation, thus maintaining the hydraulic capacity of the channels and further precluding adverse flooding impacts.

The mine has been designed to preclude subsidence in areas occupied by perennial streams (see Section 5.2.5.1). Thus, no alteration of perennial streamflow is anticipated.

Subsidence will occur in areas occupied by ephemeral stream channels. Although surface cracks that result from subsidence in the permit area are expected to heal with time in areas overlain by unconsolidated deposits and the Bluegate Member of the Mancos Shale, ephemeral stream flows may be partially intercepted prior to completion of the healing process. In addition, the broad depressions created by subsidence may locally retain runoff that would normally discharge from an area. However, the following factors indicate that the impact of subsidence on ephemeral streamflow will be minimal:

1. Ephemeral streamflow in the area is sporadic, allowing significant periods of time for surface cracks to heal between flow events.
2. Ephemeral streamflow typically carries a high sediment load. This sediment will fill remaining cracks. As the cracks heal, the potential for interception of streamflow is minimized.
3. The depressions created by subsidence are sufficiently broad that changes in slope are not typically of an ample magnitude to cause ponding in anything other than local areas.

Potential Hydrocarbon Contamination. Diesel fuel, oils, greases, and other hydrocarbon products are stored and used at the site for a variety of purposes. Diesel and oil stored in above-ground tanks at the mine surface facilities may spill onto the ground during filling of the storage tank, leakage of the storage tank, or filling of the vehicle tank. Similarly, greases and other oils may be spilled during use in surface and underground operations.

The probable future extent of the contamination caused by diesel and oil spillage is expected to be small for three reasons. First, because the tanks are located above ground, leakage from the tanks can be readily detected and repaired. Second, spillage during filling of the storage or vehicle tanks is minimized to avoid loss of an economically valuable product. Finally, the mine has a Spill Prevention Control and Countermeasure Plan that provides inspection, training, and operation measures to minimize the extent of contamination resulting from the use of hydrocarbons at the site.

Coal Spillage During Hauling. Coal is hauled over access road from the mine to State Highway 10 and future destinations. Past experience has indicated that no substantial quantities of coal have been spilled during transport. If coal is spilled, it may wash into local streams during a runoff event prior to cleanup. Possible impacts to the surface water include increases in total suspended solids and turbidity from the fine coal particulates. The probability of a spill occurring in an area sufficiently close to a stream channel to introduce coal to the stream bed is extremely small.

Pages ~~174~~ 175 through 181 intentionally left blank.

XIII.C ENVIRONMENTAL RESOURCE INFORMATION

XIII.C.1 PERMIT AREA

The lands subject to coal mining operations within the IBC area are noted on Plate I-1. It is not anticipated that individual permits will be sought for subareas within the IBC area. A discussion of cultural resources within the IBC area is provided in Appendix XII-3 of the approved MRP. This prior Class I survey, conducted in May 2005, included all of the area of the Federal Lease IBC and identified no cultural resources within that area. A class 3 survey was conducted in the area in January 2007. The results of that survey are provided in Appendix XIII-3. According to the information provided in the survey, ~~T~~there are no cemeteries within 100 feet of the IBC boundary. There are no public parks located within the IBC area. There are no Historical or cultural resources eligible for listing in the National Register of Historic Places. There are no lands within the boundaries of the National System of Trails or Wild and Scenic Rivers System within the IBC area.

XIII.C.2 SOIL RESOURCE INFORMATION

Soil resources in the IBC area are depicted in Figure XIII-1(published soil survey) and Figure XIII-1a (unpublished NRCS soil survey). Descriptions of these soils are provided in Appendix XIII-1. Soil series descriptions in the appendix were obtained from the U.S. Natural Resources Conservation Service (2006). Descriptions of individual map units on Figure XIII-1 were obtained from Swenson et al. (1970). Descriptions of individual map units on Figure XIII-1a were obtained from the NRCS field office in Price. The data depicted on the map and in the table on Figure XIII-1a are not approved or published, and as such are subject to change per the NRCS office. Soils within the IBC area tend to be fine grained, ranging generally from loam to silty clay loam. If irrigated, the soil supports alfalfa and similar crops. Otherwise, the soils mostly support rangeland plants such as shadscale, Indian ricegrass, greasewood, and/or saltgrass. Minchey loam, Penoyer loam, ~~and~~ Ravola loam, and Tusher loam are considered prime farmland when irrigated (Appendix XIII-1 and Figure XIII-1a). ~~About 2 acres of Penoyer Loam and 10 acres of Ravola Loam are irrigated and, therefore, may be prime farmland within the IBC area. Although s~~Subsidence~~-related~~ ~~is not planned,~~ ground movement will be monitored and mitigated in accordance with Section V.B.1 of the MRP.

The vegetation map of the Federal IBC area found in Appendix XIII-2 and Plate VIII-1 shows the area that is irrigated pasture and areas of dry (not irrigated) pasture. These data were compiled from a field visit during the summer of 2006. The data available from the NRCS field office were compiled by looking at an aerial photo and talking to the land owners. According to the U.S. Farm Service Agency, this information is updated every few years and is subject to change. The land owner decides which fields to irrigate based on several factors, including drought conditions, pasture needs, availability of irrigation water, etc. Hence, boundaries between irrigated and non-irrigated pasture, as well as between pasture and rangeland, are likely to change on occasion.

Additional information regarding soil resources in the IBC and adjacent areas is provided in Chapter VII of the approved MRP. Impacts to soil resources are not anticipated as a result of mining under this application since no new surface disturbances are planned.

XIII.C.3 VEGETATION RESOURCE AND LAND USE INFORMATION

Information concerning vegetation resources within the IBC area is provided in Appendix XIII-2. Three plant communities are present in the IBC area, namely greasewood, shadscale/winterfat, and pasture (both irrigated and dry land). The vegetation map in Appendix XIII-2 and Plate VIII-1 depict pastureland (irrigated and dry), greasewood, and shadscale/ winterfat within the Federal IBC area. Defined land uses would be pastureland and undeveloped, as indicated on Figure XIII-1b. Chapter IX, Plate 10-1 shows wildlife use of the area. Information presented in Appendix XIII-2 indicates that federally-listed threatened or endangered plant species are not likely to exist in the IBC area. No impacts to vegetation are anticipated from mining in the IBC area due to the planned non-disturbance of the surface.

XIII.C.4 FISH AND WILDLIFE RESOURCE INFORMATION

Information regarding fish and wildlife resources within the IBC and adjacent areas is provided in Appendix XIII-2. Additional information regarding fish and wildlife resources in the IBC and adjacent areas is provided in Chapter IX of the approved MRP. The IBC area is located within a zone of high value winter habitat for elk.

It is unlikely that raptors occur within the IBC area. One prairie dog community is located with the IBC area (see Chapter IX of the approved MRP). Given the lack of ~~planned subsidence~~new surface disturbances, it is not anticipated that impacts will occur to these or other wildlife resources from coal mining in the IBC area. Although several Federally-listed threatened or endangered animal species are known to occur in Emery County, a lack of appropriate habitat greatly reduces the potential for any of these species to occur within the IBC area (see Appendix XIII-2).

XIII.C.5 GEOLOGIC RESOURCE INFORMATION

Information regarding geologic resources within the IBC and adjacent areas is provided in Chapter V of the approved MRP. The Bluegate Shale member of the Mancos Shale outcrops over the entire surface of the IBC area. This unit is a saline, blue-gray silty mudstone and siltstone with occasional, thin sandstone lenses. The Bluegate Shale abruptly overlies the Ferron Sandstone member of the Mancos Shale. The Ferron Sandstone consists of interbedded layers of sandstone, siltstone, shale, and coal, with the coal to be mined in the IBC area occurring in the upper portion of the Ferron Sandstone in a layer known as the IJ zone. The Tununk Shale member of the Mancos Shale underlies the Ferron Sandstone.

As noted in Section V.A.3 of the approved MRP, the targeted commercial horizon for the Emery Mine is referred to as the I zone or the IJ zone. This zone consists, from the base upwards, of the Lower I-5 horizon (an 8- to 10-foot thick coal layer), the First Slip (a 0.1- to 0.2-foot thick clay parting), the Lower I-1 horizon (a 3- to 4-foot thick coal layer), the Second Slip (a thin clayey layer), the Upper I horizon (a 3- to 4-foot thick coal layer), and the J horizon (a 3- to 4-foot thick layer of interbedded coal and shale). In the northeastern portion of the mine area (i.e., the area of the Federal Lease IBC), the Lower I-5 horizon is the preferred mining horizon due to its favorable thickness and quality. Toward the center of the mine area, the Lower I-1 and Upper I horizons present more favorable mining conditions, and the mine has ramped up to the higher level. Further to the southwest, the Lower I-5 is again the preferred mining horizon. Given this variability, the mining horizon at the Emery Mine is typically referred to as a zone rather than a seam.

Based on data provided on Plates V-~~20~~ 19 through V-22 of the approved MRP, approximately 300 to 500 feet of overburden overlies the IJ zone within the IBC area. Roof and floor materials above and below the IJ zone within the IBC area are expected to be as indicated in Section V.A.4 of the approved MRP, consisting of interbedded sandstone and shale. Dark gray shale typically contacts the roof of the coal, with several feet of irregularly laminated, light gray, fine-grained quartz sandstone above the shale. The floor material is generally dark olive gray, coaly, silty shale interbedded with light gray, fine grained quartz sandstone.

According to Section V.A.4 of the approved MRP, the pH of the roof material ranges from about 5 to 9, with the pH of the floor materials tending to be slightly higher. The roof and floor materials tend to have low salinity (specific conductance less than 4.0 mmhos/cm), with moderate to high sodium adsorption ratios (1.8 to 28) and concentrations of heavy metals that are sufficiently low to not influence reclamation decisions.

The coal, overburden, and underburden in the IBC area are unlikely to have substantial acid-forming potential, as indicated by the pH of the rock and the slightly alkaline nature of water that has historically discharged from the Emery Mine (pH 7.1 to 8.5 – see Section V.A.5 of the approved MRP). Furthermore, as indicated in Section V.A.6 of the approved MRP, the sulfur content of the coal is generally low (typically 0.5 to 2.0 percent, with an average of about 0.7 percent), with variable proportions of the sulfur existing as pyrite. Concentrations of toxic constituents in the coal, overburden, and underburden are low (see Section V.A.4 of the approved MRP). Additional drilling in the Federal IBC area is approved and anticipated to take place in 2007. Section V.A.4 will be updated when this information is available.

A comparison of Plates V-20 and VI-4 of the approved MRP indicates that the complete thickness of the Ferron Sandstone is probably saturated within the IBC area. Additional information regarding groundwater within the IBC and adjacent areas is provided below and in Chapter VI of the approved MRP.

XIII.C.6 HYDROLOGIC RESOURCE INFORMATION

XIII.C.6.1 Baseline Information

Mining within the IBC area will not involve the construction of additional surface facilities. ~~Furthermore, as indicated in Section XIII.A, coal will be mined under this application using room and pillar methods without pillar extraction (i.e., first mining only).~~ Hence, no surface disturbance is planned.

Baseline hydrologic data have been collected from several surface and groundwater monitoring locations adjacent to the IBC area (see Plates VI-1 and VI-3 of the approved MRP). These data are discussed in Chapter VI of the approved MRP. Given the lack of surface disturbance planned for the IBC area and the close location of the IBC area relative to the existing permit area, the existing baseline data are considered adequate for the IBC area.

XIII.C.6.2 Groundwater Information

As indicated in ~~Chapter~~ Section VI.A.2 of the approved MRP, groundwater within the mine permit and adjacent areas (including the IBC and adjacent areas) occurs primarily within the Ferron Sandstone. This sandstone is situated between the overlying Bluegate Member of the Mancos Shale and the underlying Tununk Member of the Mancos Shale, both of which are relatively impermeable and considered aquicludes. The Ferron Sandstone outcrops in a series of prominent cliffs along the eastern edge of the Emery coal field and dips to the northwest beneath the ground surface. The continuity of the Ferron is broken in the subsurface by the Joes Valley-Paradise fault zone, which exists immediately northwest of the permit area.

WILDLIFE

Geographical database information from the State of Utah, Division of Wildlife Resources (DWR) suggested the area is not critical habitat for pronghorn, elk, mule deer, sage grouse, or rocky mountain bighorn sheep. In addition to the species listed in Chapter IX, Plate 10-1 (Selected Wildlife Information), the database does suggest the Federal Lease IBC Area to be "High Value Winter Habitat" for elk (see attached *Wildlife Habitat Map of the Federal Lease IBC Area*).

Raptors

In 2001 DWR biologists visited the site along with representatives from Consolidation Coal Company. At that meeting it was suggested that there was a low probability of raptor occurrence in the area (refer to: *Biological Impacts at the 4th East Portal Area at the Emery Deep Mine*. 2002. Mt. Nebo Scientific. Springville, UT). Since that time Consolidation Coal Company has participated in the annual raptor surveys conducted by DWR and other coal mine operators in the area.

In addition, during site visits by *Mt. Nebo Scientific, Inc*. surveys were conducted for major prairie dog communities in the study area. Prairie dog communities are known to be important habitat for burrowing owls (*Athene cunicularia*). One such community was located previously and is shown on a map in the Emery Mine's Mining & Reclamation Plan [Selected